IN THE UNITED STATES DISTRICT COURT FOR THE

NORTHERN DISTRICT OF OKLAHOMA

W. A. DREW EDMONDSON, in his capacity as ATTORNEY GENERAL OF THE STATE OF OKLAHOMA and OKLAHOMA SECRETARY OF THE ENVRONMENT C. MILES TOLBERT, in his capacity as the TRUSTEE FOR NATURAL RESOURCES FOR THE STATE OF OKLAHOMA,	)
Plaintiffs,	)
vs.	) 4:05-CV-00329-TCK-SAJ
TYSON FOODS, INC., et al,	)
Defendants.	)

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THE VIDEOTAPED DEPOSITION OF

VALERIE J. HARWOOD, Ph.D., produced as a witness on behalf of the Defendants in the above styled and numbered cause, taken on the 29th day of January, 2008, in the City of Tulsa, County of Tulsa, State of Oklahoma, before me, Bonnie Glidewell, a Certified Shorthand Reporter, duly certified under and by virtue of the laws of the State of Oklahoma.

Q Pseudonomas, that one is going to be tough for me. Aeronomas -- say that again.
A Aeronomas.
Q Aeronomas, Enterococci, and bacteria that are either unknown to humans or that are unknown to you? 08:50AM
A Microbacterium/avium complex.
Q Okay.
A Cyanobacteria in high concentrations. Again, I'm dredging my memory, but those are the ones that come to my mind at the moment. 08:50AM
Q Okay. Thank you so much. Now, in this case, is it true that you discovered a bacteria that had not previously been catalogued?
A Correct.
Q What is that bacteria? Does it have a name? 08:51AM
A It's a Brevibacterium species. Brevibacterium is B-r-e-v-i-b-a-c-t-e-r-i-u-m.
Q Does this bacteria have a specific name, though? I want to make sure I refer to it by something where we can understand each other. 08:51AM
A Oh, you can just call it the Brevibacterium if you want to.
Q All right, I'm going to call it the Harwood bacteria, because then that will separate it from the others, and like Edmund Hillary, you will be 08:51AM

A No, I didn't say -- I didn't say I don't use statistics.
Q Okay. Let's clarify on that. What use of statistics do you -- what use do you make of statistics in your work? 09:31AM
A So if we wanted to determine if there was a difference in contamination in -- level of contamination from one area of a watershed or from one watershed to the next, we would use statistics to determine whether there was a significant 09:31AM difference. We use multi-variant statistics to try to tease out dominant factors that influence belonging to one category or another. So discriminate analysis, principal components analysis. We use correlation and regression to see 09:32AM how variables are related to each other, so yes, we use a lot of statistics.
Q And did you employ the services of a statistician in this case?
A No, I did not. 09:32AM
Q Are you aware of any statistician on the team?
A Not specifically. I know we have some members that are well versed in statistics. I'm not specifically aware of a statistician.
Q Are you an expert in statistics? 09:32AM

A No, I'm a user of statistics.
Q Did you attempt to quantify the amounts of the various types of livestock in the watershed?
A I did not.
Q Did anyone? 09:32AM
A Yes.
Q Who?
A Chris Teaf was working on that, I believe.
Q And did he provide that work to you?
MR. TUCKER: Could you all speak up? 09:33AM
There's a very loud machine out by the window.
MR. ELROD: I think he's almost through.
MR. JORGENSON: How we doing on the tape? Okay. Will you read the last question back.
(Whereupon, the court reporter read back the previous question.)
THE WITNESS: No, I don't have a complete set of those results.
Q (By Mr. Jorgenson) So did you --
MR. TUCKER: Have a complete set of? 09:33AM
THE WITNESS: I don't have a complete set of his work, of those results.
Q (By Mr. Jorgenson) Did you rely on his work in reaching your opinions?
MR. PAGE: Object to the form. 09:33AM

A Yes.
Q You, alone, or anyone else?
A Well, of course, Tamzen and Jennifer participated fully in preparing it, and then we had -- I know that when we talked, David Page, Roger Olsen and I, talked about things to include that would make -- that would be inclusive of everything that we had done, so we all talked about that to make sure that all the material was here that would be necessary. 01:49PM
Q And is this report dated December 2007 your final report?
MR. PAGE: Object to the form.
THE WITNESS: It is the final report of this report. Now, there may be -- well, we're still working on it, on the samples, so there could be more added later on. 01:50PM
Q (By Mr. Jorgenson) Are you gathering additional samples?
A No, not to my knowledge. 01:50PM
Q Are you testing the samples that have already been gathered?
A Yes.
Q What are you testing them for?
A The Brevibacterium biomarker. 01:50PM

targets.
Q I think I can recap here and move on and save us some time. Is it your testimony that bacteria laying out in the sunlight on a field may be killed or may die? 02:23PM
A Wow, that was a weird segue. Bacteria --
Q Laying out on a field in the sunlight may die.
A Well, again we go back to that definition of what is bacterial death. They would rapidly become unculturable; they would less rapidly become 02:23PM nonviable. But if they didn't have any place to hide and if they dried out, then, over time, they would finally die.
Q And if you took up a sample of the field and it included dead bacteria, though, the DNA from 02:23PM those dead bacteria could be amplified in this PCR process?
A It could be, although, again, dead bacteria rapidly becomes food for other bacteria in other situations. 02:24PM
MR. TUCKER: Rapidly what, I'm sorry?
THE WITNESS: Dead bacteria rapidly become food for other bacteria under these situations and so eventually -- pretty rapidly that DNA would be chewed up. 02:24PM

the case of humans, we had, as I mentioned, septic pump-out trucks and wastewater influent. And in the case of dairy cattle, we had the slurry that comes from the barns, and beef cattle were composite fecal samples; swine was a slurry from the farm; ducks and geese were composits. 02:41PM

Q Then you used primers as well?

A Uh-huh (nodding head up and down).

Q What do the primers do?

A So the primers are an integral part of the PCR. The primers basically confer the specificity of the assay. They determine what piece of DNA will be amplified. And if a bacterial genome, if it's DNA doesn't have that particular sequence that's specified by the primers in it, then you won't get a PCR product. I mean that's how we know that the gene is not there. 02:41PM 02:42PM

Q To try to convey it to the court in laymen's terms, so the primers are kind of like a selective Xerox machine? 02:42PM

A Right.

Q They go out and find things that look --DNA that looks exactly like the DNA they have been told to look for and they make copies of it?

A Correct. 02:42PM

Q And if the DNA does not look exactly like the DNA they have been told to look for, they don't make copies of it?
A That's about right.
Q In reading the North Wind report, it seems that North Wind tested to determine the specificity of these primers; is that right? 02:42PM
A Yes.
Q And they determined, they tested to determine whether the primers you used would make copies of, would amplify Brevibacterium "sp." What does that stand for? 02:42PM
A Species. So it was actually a Brevibacterium that was cultured in another study and its gene sequence was closely related to the Brevibacterium biomarker that we had developed, so we wanted to make sure that our primers wouldn't mistakenly amplify this DNA. 02:43PM
Q Okay, I can see why you'd want to do that. And I believe they also actual cultured the second closest organism or the organism that was second closest to the one you found? 02:43PM
A Right.
Q But they did not, I understand, test to see if the primers would amplify the first-most closest

type of bacterium, or the third?
A Those, I think, were uncultured, though, so we can't test that. All we can do is test compare our primers.
Q So, boiling it all down -- I'm trying to get to a conclusion that the judge, I think, will understand, we don't know whether the primers you are using were out there making copies of the bacteria that is most like this bacteria and the one that's third-most like this bacteria; there's no way to know? 02:43PM 02:43PM
A The fact is we can never know that in microbial analyses, even with the standard methods that we use for bacteria. We're always, always betting on or doing as much validation as we can, but in the case where you don't have a bacterium to test against, then you just don't have it. 02:44PM
Q Right. You just have to -- there's an error rate there, but it's not known or knowable?
MR. PAGE: Object to form. 02:44PM
Q (By Mr. Jorgenson) Is it true that there is an error rate there but it's not known or knowable?
A There's a possible error rate, error rate there. But we did, if you'll notice, that, later on, we sequenced that marker that we arrived at from 02:44PM

the poultry litter and found that, consistently, that we have the right sequence, so it's -- you know at least in the chicken samples, it's not targeting the wrong bacterium in the poultry litter samples.

Q So are you saying that you know, throughout your work, that it's not, that your primers are not amplifying the two unknown bacteria? 02:44PM

A You know --

Q Or is that just an uncertainty you have to deal with? 02:45PM

A That's an uncertainty, yeah. But again, it didn't really -- wasn't really of concern.

Q Okay.

A And if you're getting this published, nobody would question the procedure that we used. 02:45PM

Q Now, talking about host specificity and, again, hoping that we can say it in a way the judge knows. Is it true that host specificity is referring to the idea that a bacteria is closely related with a particular host? 02:45PM

A Yes.

Q But uniqueness is very rare if not nonexistent?

A Particularly in bacteria. You might be more likely to find a unique virus, a species-unique 02:45PM

Q Could you have identified a biomarker for cattle in this watershed?
A We -- I use, in my lab, a marker for ruminants which includes both deer, deer, cattle, goats and sheep. The only cattle biomarkers that are out are very new, so they would've had to be very extensively validated, cattle-specific. 04:20PM
Q Is your biomarker very new?
A Our biomarker is new, yes. But, again, it's been extensively validated. 04:21PM
Q But it's only been validated by your own evaluation?
A That's correct.
Q Is that correct?
A Correct. 04:21PM
Q And the extensive validation you're talking about for the new biomarkers for cattle, would that be only by the person who would've discovered it or would that be by others validating that biomarker?
A Well, the way I validate a biomarker is I use it in a lab, and I go through all the validation that's previously occurred, so I just repeat it. 04:21PM
Q There is an existing biomarker, however, for ruminants?
A Correct. 04:21PM